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Indian Standard

IS 233 (Part 4) : 2020

वस्त्रादि — कपास रेशों की लंबाई प्राचलों के निर्धारण के लिए विधियां

भाग 4 प्रकाशिक स्कैनिंग विधि द्वारा लंबाई, समरूपता अनुपात एवं समरूपता सूचक ज्ञात करना

(दूसरा पुनरीक्षण)

Textiles — Methods for Determination of Length Parameters of Cotton Fibres

Part 4 Estimation of Length, Uniformity Ratio and Uniformity Index by the Optical Scanning Method

(Second Revision)

ICS 59.060.10

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

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Physical Methods of Tests Sectional Committee, TXD 01

FOREWORD

This Indian Standard (Part 4) (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Physical Methods of Tests Sectional Committee had been approved by the Textiles Division Council.

In commercial transactions, the length of cotton fibre is determined by an expert in classing. This does not however, provide an indication of length distribution. This standard describes a method of using an optical device for the determination of the minimum length attained by a specified percentage of fibres in a test beard. The ratio of the minimum lengths attained by a specified percentage of fibres in a test beard constitutes a uniformity index.

This standard was first published in four parts in 1954 which covered methods for determination of various length parameters of cotton fibres using Ball (Sledge) Sorter Method, Ahmad-Nanjundayya Stapling Apparatus Method and Baer (Comb) Sorter Method. This standard was subsequently revised in 1978 to include two more methods (Part 5 and Part 6) namely, Thickness Scanning Method (Uster Stapling Apparatus) and Optical Scanning Method (Digital Fibrograph). Later in year 1989 through an Amendment No. 2, Ball (Sledge) Sorter Method (Part 3) and Ahmad-Nanjundayya Stapling Apparatus Method (Part 4) were deleted as these methods are not used commercially and accordingly, Part 5 and Part 6 were re-designated as Part 3 and Part 4 respectively.

This revision is based on the advancement in technology and the prevalent practices followed in the Indian textile industry and includes the following major changes:

a) Additional method of test by rapid instrument testing machine like HVI tester has been included.
b) Source of calibration cotton to be used has been modified. Accordingly, use of ICAR-Central Institute for Research on Cotton Technology (CIRCOT) calibration cotton and its quality parameters have been specified.

This standard has been published in four parts. Other parts in the series are:

Part 1 General
Part 2 Estimation of length and length distribution by the array method
Part 3 Estimation of length and length distribution by the thickness scanning method

The fibre length of cotton is directly related to its spinning performance; generally speaking, longer cottons can be spun to finer counts. The method of estimating fibre length or ‘staple’ of cotton used in the trade has long been accepted to be liable to considerable subjective and personal errors, and the need for accurate methods of determining the mean fibre length of cotton and the proportion by weight of fibres of different length grades in cotton has long been recognized.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’.

Indian Standard

TEXTILES — METHODS FOR DETERMINATION OF LENGTH PARAMETERS OF COTTON FIBRES

PART 4 ESTIMATION OF LENGTH, UNIFORMITY RATIO AND UNIFORMITY INDEX BY THE OPTICAL SCANNING METHOD

(Second Revision)

1 SCOPE

This standard (Part 4) prescribes a method for estimation of 2.5 percent span length, 50 percent span length, uniformity ratio and uniformity index of cotton fibres by optical scanning method.

2 PRINCIPLE

2.1 A randomly aligned tuft of cotton fibres is scanned by an optical device and the minimum length spanned by certain specified percentages of the fibres is determined. The ratio of lengths spanned at two percentages is considered as a measure of fibre length uniformity.

2.2 In High Volume Instrument (HVI) tester, the measurements of length and uniformity index of cotton fibres in a tapered beard are derived from the measured length distribution of cotton fibres. Fibres are caught at random along their lengths to form a tapered beard. The tapered beard is scanned from base to tip to form the fibre length distribution. The ratio of mean length and upper half mean length expressed as percentage is considered as a measure of uniformity index.

3 APPARATUS

3.1 Digital Fibrograph — It is an optical instrument which scans a randomly aligned tuft of fibres to estimate the length of specific portions of the length frequency distribution, like 2.5 percent span length, 50 percent span length (*see* Note).

NOTE — Mention of the name of specific (or proprietary) instruments is not intended to promote or give preference to the use of these instruments or exclude the use of other suitable instruments.

3.2 Rapid Instrument Testing Machine (HVI Tester) — HVI systems measure length parameters of cotton samples by the fibrogram technique. The HVI system gives an indication of the fibre length distribution in the bale/other package by use of a length uniformity index. The uniformity index is obtained by dividing the mean fibre length by the upper-half-mean length and expressing the ratio as a percent (*see* Note).

NOTE — Mention of the name of specific (or proprietary) instruments is not intended to promote or give preference to the use of these instruments or exclude the use of other suitable instruments.

3.2.1 Upper Half Mean Length (UHML) is the mean length by the number of fibres in the largest half by weight of fibres in a cotton sample, usually measured from the fibrogram. Upper half mean length is normally equivalent to the staple length.

3.3 A Set of Hand Combs or a Fibro-Sampler — for preparation of tufts.

4 PREPARATION OF TEST SPECIMEN

4.1 Prepare the test specimens from the laboratory sample by one of the following methods given in **4.1.1** or **4.1.2**.

4.1.1 *Hand Combing Method* — Pick up a handful of cotton from the laboratory sample and separate it into two parts by pulling so as to expose a fresh surface of projecting fibres. Holding one of the hand combs in one hand and the opened lump of cotton in the other, transfer some of the projecting fibres on to the comb. Pick fresh lumps of cotton, and proceed in the same manner so that a pair of combs is filled with sufficient quantity of fibres drawn from 8 to 10 randomly picked lumps. Hold one comb in each hand, and untangle and parallelize the projecting fibres by mutual combing. The pair of combed beards constitutes the test specimen.

4.1.2 *Fibro-Sampler Method* — Mount one of the fibro-sample combs in the comb holder of the fibro-sampler, with the teeth upper most. Place the laboratory sample in the cage and press it against the perforated surface. Maintain the pressure and rotate the sample holder round the drum counter-clockwise through 360º, for 5 strokes of the brush. Remove the loaded comb from the holder. Turn the sample in the cage to expose a fresh surface, and mount fibres in one more comb. Either one or a pair of combed beards constitute the test specimen’ depending upon the model of the instrument being used.

5 PROCEDURE

5.1 Digital Fibrograph

5.1.1 Assure that the fibrograph is in proper operating condition; check calibration according to instruction manual (*see* Note).

NOTE — Mention of the name of specific (or proprietary) instruments is not intended to promote or give preference to the use of these instruments or exclude the use of other suitable instruments.

5.1.2 Insert the loaded pair of combs into the comb holder, and brush the fibres downward carefully to remove loose fibres and straighten the rest.

NOTE — In some fibrograph models a single comb constitutes the test specimen.

5.1.3 Lower the light house; wait for the signal to indicate 'balance'. See that the amount counter reading is within specified limits. If the quantity of fibres is too much or too less, reject the test specimens and prepare fresh ones.

5.1.4 Follow the procedure laid down for respective models and record the 50 percent and 2.5 percent span length values.

5.2 Rapid Instrument Testing Machine (HVI Tester)

NOTE — Mention of the name of specific (or proprietary) instruments is not intended to promote or give preference to the use of these instruments or exclude the use of other suitable instruments.

5.2.1 *Calibration*

For calibration of length parameters, calibrate using ICAR-CIRCOT calibration cottons (*see* Note) as per the instrument manufacturer's recommendation and follow instrument manufacturer's procedures. Quality characteristics of ICAR-CIRCOT calibration cottons for HVI mode and ICC mode are given in Table 1 and Table 2, respectively.

NOTE — ICAR - CIRCOT calibration cottons are available from the ICAR - Central Institute for Research on Cotton Technology, 5, Adenwala Road, Grant Road West, Matunga, Mumbai, Maharashtra 400019, e-mail: circotcalibcot@rediffmail.com.

5.2.2 *Sampling*

Take one subsample from the bale sample. One subsample from each bale shall consist of two portions, one portion from each side of the bale. Take the subsample from the space between the wires or ties in such a way that each portion shall be 305 mm

Table 1 Quality Characteristics of ICAR-CIRCOT Calibration Cottons for High Volume Instrument (HVI mode)

(*Clause* 5.2.1)

Sl No.	Code	UHML *mm*	Uniformity Index (UI) *Percent*	Micronaire Value *µg/inch*	Tenacity @ 3.2 mm Gauge Length *g/tex*	Elongation *Percent*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	S-4	22.2	77	4.8	22.7	5.3
ii)	L-3	30.7	83	3.6	29.0	5.0
iii)	EL-3	32.0	81	2.8	31.5	6.0
iv)	Tolerance	± 0.5	± 1.0	± 0.10	± 1.5	–

Table 2 Quality Characteristics of ICAR-CIRCOT Calibration Cottons for High Volume Instrument (ICC mode)

(*Clause* 5.2.1)

Sl No.	Code	2.5 percent Span Length *mm*	Uniformity Ratio (UR) *Percent*	Micronaire Value *µg/inch*	Tenacity @ 3.2 mm Gauge Length *g/tex*	Elongation, *Percent*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	S-4	22.0	48	4.8	17.6	5.3
ii)	L-3	30.9	44	3.6	23.8	5.0
iii)	EL-3	32.0	43	2.8	27.5	6.0
iv)	Tolerance	± 0.5	± 1.0	± 0.10	± 1.5	–

long and 154 mm wide. Weight of each portion shall be 114 g approximately so as to give a total specimen weight of 228 g approximately.

5.2.3 Take 5 specimens from each subsample of the bale sample and place the specimen into the instrument's length measurement area. Follow the instructions of the equipment manufacturer for calibration and testing procedure. For HVI testing, HVI mode shall be used.

5.2.4 For the bale sample, report the average of the 5 specimens for upper half mean length to the nearest one hundredth of a millimetre. For the bale sample, report the average of the 5 specimens for uniformity index to the nearest one tenth of a unit.

6 CALCULATION AND EXPRESSION OF RESULTS

6.1 Digital Fibrograph Method

Express 2.5 percent span length and 50 percent span length correct to 0.1 mm. Calculate the uniformity ratio as follows:

$$\text{Uniformity ratio} = \frac{\text{50 percent span length}}{\text{2.5 percent span length}} \times 100$$

6.2 Rapid Instrument Testing (HVI) Method

Express mean length and upper half mean length correct to 0.1 mm. Calculate the uniformity index as follows:

$$\text{Uniformity index} = \frac{\text{Mean length}}{\text{Upper half mean length}} \times 100$$

7 REPORT

7.1 The report shall include the following information:

a) Reference to this standard;

b) 50 percent span length obtained from fibrogram or mean length obtained from High Volume Instrument (HVI);

c) 2.5 percent span length obtained from fibrogram or upper half mean length obtained from High Volume Instrument (HVI);

d) Uniformity index or uniformity ratio (rounded off to two significant figures);

e) Type of instrument used;

f) Type of combing used;

g) Mode of testing HVI or ICC; and

h) Details of any operation not specified in this standard, or incidents likely to have had an influence on the results.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Physical Methods of Test Sectional Committee, TXD 01

Organization	*Representative(s)*
ICAR – Central Institute for Research on Cotton Technology, Mumbai	Dr P. G. Patil (***Chairman***)
Bidhata Industries Pvt Ltd, Mumbai	Shri R. K. Pacheriwala Shri Rohit Pacheriwala (*Alternate*)
Central Silk Technological Research Institute, Bangaluru	Dr Subhas V. Naik Dr Prakash Bhat (*Alternate*)
Delta Ropes Mfg Co, Kolkata	Shri Anand Majaria Shri Aayush Majaria (*Alternate*)
Directorate General of Quality Assurance, Ministry of Defence, New Delhi	Shri R. K. Boruah Shri S. S. Kashyap (*Alternate*)
Garware Technical Fibres Limited, Pune	Shri Sanjay Vasudeo Raut Shri Sachin Kulkarni (*Alternate*)
ICAR – Central Institute for Research on Cotton Technology, Mumbai	Dr Pradeep Mandhyan Dr T. Senthilkumar (*Alternate*)
Indian Institute of Technology, New Delhi	Prof R. S. Rengasamy Prof Apurba Das (*Alternate*)
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Organization	*Representative(s)*
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The Bombay Textile Research Association, Mumbai	Shri R. A. Shaikh Shrimati Pragti Kulkarni (*Alternate*)
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World Traders Manufacturing Co, Mumbai	Shri Varun Gupta Shri Aditya Gupta (*Alternate*)
In personal capacity (*B-21, Parijat, Talepakhadi, Eskar Road, Borivali, Mumbai-400091*)	Dr R. P. Nachane
BIS Directorate General	Shri A. K. Bera, Scientist 'F' and Head (TXD) [Representing Director General (*Ex-officio*)]

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Shri J. K. Gupta
Scientist 'D' (TXD), BIS

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices: *Telephones*

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002 — 2323 7617, 2323 3841

Eastern : 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi
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